CLAIMS

What is claimed is:

1. A system having an intensity detector, the system comprising:

at least one cascade of N gain elements operably couplable with analog circuitry, the at least one cascade having at least

N greater than or equal to a positive integer sufficient to provide said at least one cascade with a gain such that a predetermined operable signal at an input of said at least one cascade generates a signal at an output of said at least one cascade that is larger than a predetermined operable threshold value,

an input of a first gain element of said at least one cascade operably couplable with the analog circuitry,

a gain element of the at least one cascade having a gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized,

one or more output value detection circuits respectively operably coupled with one or more outputs of the N gain elements, and

one or more timing recordation circuits operably coupled with said one or more output value detection circuits.

2. The system of Claim 1, wherein the analog circuitry further comprises:

a photo-detector array having at least one output.

3. The system of Claim 2, wherein said photo-detector array having at least one output further comprises:

at least one of a charge coupled device (CCD) array or a complementary metal oxide semiconductor (CMOS) array.

4. The system of Claim 1, wherein said N greater than or equal to a positive integer sufficient to provide said at least one cascade with a gain such that a predetermined operable signal at an input of said at least one cascade generates a signal at an output of said at least one cascade that is larger than a predetermined operable threshold value further comprises:

said N is greater than or equal to a positive integer sufficient to provide said at least one cascade with a gain such that a substantially minimally rated output signal of a photo-detector array applied to the input of said at least one cascade generates a signal at the output of said at least one cascade that is larger than the predetermined threshold value.

5. The system of Claim 1, wherein said N greater than or equal to a positive integer sufficient to provide said at least one cascade with a gain such that a predetermined operable signal at an input of said at least one cascade generates a signal at an output of said at least one cascade that is larger than a predetermined operable threshold value further comprises:

said N is greater than or equal to a positive integer sufficient to provide said at least one cascade with a gain such that a predetermined signal at an input of said at least one cascade generates a signal at the output of said at least one cascade that is larger than a substantially minimally rated input of a display circuit.

6. The system of Claim 1, wherein the gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

a noise factor defined as the ratio of a Signal Power to Thermal Noise ratio at the input of said at least one cascade to an amplified Signal Power to Thermal Noise ratio at the output of the at least one cascade: $(S_{input}/N_{input})/(S_{output}/N_{output})$.

7. The system of Claim 1, wherein the gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

a noise factor defined as a ratio of an output noise power of said at least one cascade to the portion thereof attributable to thermal noise in an input termination at standard noise temperature.

8. The system of Claim 1, wherein the gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

a noise factor defined as a ratio of actual output noise to that which would remain if the at least one cascade itself did not introduce noise.

9. The system of Claim 1, wherein the gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

the gain larger than one but less than 1.001.

10. The system of Claim 1, wherein the gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

the gain larger than one but less than 1.01.

11. The system of Claim 1, wherein the gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

the gain of a gain element is larger than one by an amount that is practicably small such that the noise contribution to the low noise amplifier from a gain element is substantially minimized.

12. The system of Claim 1, wherein said gain element of the at least one cascade having a gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

an impact ionization-based amplifier having a gain larger than one by an amount such that the noise factor of said at least one cascade operating on the predetermined signal at the input of said cascade is substantially minimized.

13. The system of Claim 12, wherein said impact ionization-based amplifier further comprises:

a solid state electron multiplying amplifier.

14. The system of Claim 1, wherein said gain element of the at least one cascade having a gain larger than one by an amount such that a noise factor of said at least one cascade

operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

an over-biased amplifier.

15. The system of Claim 1, wherein said gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined operable signal at the input of said at least one cascade is substantially minimized further comprises:

the gain larger than one by an amount such that the noise factor of said at least one cascade operating on the predetermined signal at the input of said at least one cascade is less than 1.2.

16. The system of Claim 1, wherein said one or more output value detection circuits respectively operably coupled with one or more outputs of the N gain elements further comprises:

one or more comparators respectively operably coupled with one or more outputs of the N gain elements.

17. The system of Claim 1, wherein said one or more output value detection circuits respectively operably coupled with one or more outputs of the N gain elements further comprises:

M comparators operably coupled with M gain elements of the at least one cascade, wherein M is an integer that is smaller than N; and

M reference values operably coupled with said M comparators.

18. The system of Claim 1, wherein said one or more timing recordation circuits operably coupled with said one or more output value detection circuits further comprises:

at least one processor operably coupled to said one or more output value detection circuits, said processor configured by logic to record one or more times at which the one or more output value detection circuits trigger.

19. A method of constructing a system having an intensity detector with N gain elements, said method comprising:

configuring a first gain element such that an input of the first gain element is operable to receive an input signal;

connecting an output of a k'th gain element to an input of a k+1'th gain element, wherein k is an integer that is at least 1;

connecting one or more outputs of the N gain elements respectively to one or more value detection circuits;

configuring an N'th gain element such that an output of the N'th gain element is operable to generate an output signal;

N being a positive integer such that a ratio between the output signal and the input signal is larger than a predetermined threshold gain when the input signal is received at the input of the first gain element; and

connecting the one or more value detection circuits to a timing recordation circuit.

20. The method of Claim 19, wherein at least one gain element has a gain larger than one but less than 1.001.

21. The method of Claim 19, wherein at least one gain element has a gain larger than one but less than 1.01.

22. The method of Claim 19, wherein at least one gain element has a gain generated based on an impact ionization process.

23. The method of Claim 19, wherein at least one gain element has a gain that is provided by over biasing the gain element.

24. The method of Claim 19, wherein at least one gain element comprises a solid state electron multiplying amplifier.

25. The method of Claim 19, wherein the at least one gain element has a gain larger than one by an amount such that a noise factor of the N gain elements is practicably minimized.

26. The method of Claim 19, wherein the one or more value detection circuits comprise one or more comparators.

27. A method of determining an intensity measure, said method comprising:

receiving an input signal at an input of a first gain element of a cascade of N gain elements; and

assessing an intensity in response to one or more times associated with one or more output signals of the cascade of N gain elements satisfying one or more threshold values.

28. The method of claim 27, wherein at least one gain element has a gain larger than one but less than 1.001

29. The method of claim 27, wherein at least one gain element has a gain larger than one but less than 1.01

30. The method of claim 27, wherein at least one gain element has a gain generated based on an impact ionization process

31. The method of claim 27, wherein at least one gain element has a gain that is provided by over biasing the at least one gain element.

32. The method of Claim 27, wherein at least one gain element comprises a solid state electron multiplying amplifier.

33. The method of Claim 27, wherein said assessing an intensity in response to one or more times associated with one or more output signals of the cascade of N gain elements satisfying one or more threshold values further comprises:

detecting a first time associated with a first output signal of the cascade of N gain element satisfying a first threshold value;

detecting a second time associated with a second output signal of the cascade of N gain element satisfying a second threshold value; and

assessing the intensity in response to at least one of the first time or the second time.

34. The method of Claim 33, wherein said detecting a first time associated with a first output signal of the cascade of N gain element satisfying a first threshold value further comprises:

detecting when a comparator operably coupled with a first output of the cascade of N gain element triggers.

35. The method of Claim 33, wherein said detecting a second time associated with a second output signal of the cascade of N gain element satisfying a second threshold value further comprises:

detecting when a comparator operably coupled with a second output of the cascade of N gain element triggers.

36. The method of Claim 33, wherein said assessing the intensity in response to at least one of the first time or the second time further comprises:

consulting a look-up table having one or more threshold trigger times associated with at least one of the first output and the second output of the cascade of N gain elements.

37. A system comprising:

a photo-detector array having at least one output; and

at least one cascade of N gain elements operably coupled with said photo-detector array, having at least

N greater than or equal to a positive integer sufficient to provide said at least one cascade with a gain such that a predetermined signal at an input of said at least one cascade generates a signal at an output of said at least one cascade that is larger than a predetermined threshold value,

an input of a first gain element of said at least one cascade operably coupled with an output of said photo-detector array,

a gain element of the at least one cascade having a gain larger than one by an amount such that a noise factor of said at least one cascade operating on the predetermined signal at the input of said at least one cascade is substantially minimized,

one or more output value detection circuits respectively operably coupled with one or more outputs of the N gain elements; and

one or more timing recordation circuits operably coupled with said one or more output value detection circuits.

38. A method of intensity detection, said method comprising:

detecting that a first gain element output signal of N gain elements in a cascade has satisfied a first predefined threshold; and

determining an intensity value in response to a detection that a second gain element output signal of the N gain elements in the cascade has satisfied a second predefined threshold greater than the first predefined threshold.

39. The method of claim 38, wherein said determining an intensity value in response to a detection that a second gain element output signal of the N gain elements in the cascade has satisfied a second predefined threshold greater than the first predefined threshold comprises:

recording a first time at which the first gain element output signal satisfies the first predefined threshold;

recording a second time at which the second gain element output signal satisfies the second predefined threshold; and

obtaining the intensity value in response to at least one of the first time or the second time.

40. The method of claim 39, wherein said obtaining the intensity value in response to at least one of the first time or the second time comprises:

recalling at least one intensity value in response to at least one of the first time or the second time.

41. The method of claim 39, wherein said obtaining the intensity value in response to at least one of the first time or the second time comprises:

recalling at least one intensity value in response to at least one difference between the first time and the second time.

42. The method of claim 39, wherein said obtaining the intensity value in response to at least one of the first time or the second time comprises:

recalling at least one intensity value in response to at least one historical time value compared to the first time and the second time.

43. A system having an intensity detector, the system comprising:

at least one cascade of N gain elements operably couplable with analog circuitry, the at least one cascade having at least

N greater than or equal to a positive integer sufficient to provide said at least one cascade with a gain such that a predetermined operable signal at an input of said at least one cascade generates a signal at an output of said at least one cascade that is larger than a predetermined operable threshold value,

an input of a first gain element of said at least one cascade operably couplable with the analog circuitry, and

one or more timing recordation circuits operably coupled with one or more outputs of the N gain elements.

44. The system of Claim 43, wherein said at least one cascade of N gain elements further comprises:

an impact ionization-based amplifier having a gain larger than one by an amount such that the noise factor of said at least one cascade operating on the predetermined signal at the input of said cascade is substantially minimized.

45. The system of Claim 44, wherein said impact ionization-based amplifier further comprises:

a solid state electron multiplying amplifier.

46. The system of Claim 43, wherein said at least one cascade of N gain elements further comprises:

an over-biased amplifier.

47. The system of Claim 43, wherein said one or more timing recordation circuits operably coupled with one or more outputs of the N gain elements further comprises:

one or more output value detection circuits respectively operably between the one or more timing recordation circuits and the one or more outputs of the N gain elements.